

## **Relation of Hurricane Inner Core Precipitation and Wind Structure to Tropical Cyclone Intensification and Landfalling**

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### **OBJECTIVES**

The science objectives are to a) study the role of inner core convective bursts on hurricane intensification, b) study the 3-D structure of precipitation and kinematics in mature hurricanes, and c) provide an improved understanding of the rain estimation in coastal and inland regions during tropical storm events. The emphasis of the current work is perform case studies using CAMEX-4 data sets involving the ER-2 Doppler Radar (EDOP).

### **CAMEX-3 STUDIES**

Previously, we studied the persistent, mesoscale region of intense eyewall convection contained within Hurricane Bonnie on 23 August 1998 during her intensification using observations synthesized from the CAMEX-3 observations collected from the ER-2, DC-8, and NOAA P3 aircraft. The internal structure of this convective burst and its relationship to the warm core were published in Heymsfield et al. (2001). An extension of the Bonnie study in progress, involves the internal structure of Bonnie during landfalling on 26 August 1998. The focus of this second study is on the very intense intrusion of drier, mid-level air into Bonnie, and the role of this dynamical structure on the precipitation fields. This and other observational studies on Bonnie are important in view of the numerous (at least 4) modeling studies for this case. EDOP passes across the center of a hurricane circulation provide measurements of the secondary circulation more directly than other measurements. The 3 TRMM passes on this day provide unique information on the precipitation structure which is being incorporated into the study. A paper is in progress on this work with HRD collaboration.

### **EDOP Data Collection During CAMEX-4 and Post-Processing**

One of the main first year efforts of this research involved participation in the CAMEX-4 field campaign with EDOP. On the successful completion of the field phase, the raw EDOP data files require a number of post-processing steps including radar calibration, separation of the 1-hour data files into shorter flight segments, conversion of the raw to Universal Format (UF), removal of aircraft motions from the Doppler measurements, and merging of various navigation and status data sets. This work has been completed for the first release of the data and further changes to calibration are possible as the data is examined with time. Quicklooks of the flight legs and processed data files have been sent to the CAMEX-4 archive.

## **Current Work on CAMEX-4**

***TS Chantal (8/20/01) (sheared storm):*** An extended abstract has been submitted to the 24<sup>th</sup> AMS Conference on Tropical Meteorology and Hurricanes (Heymsfield et al. 2002). The plan is to work toward an observational paper on the sheared structure of this storm using the aircraft radars, dropsondes, and other data sets. There is a strong convective burst in progress during the aircraft flights and one of the questions of interest is why this storm didn't develop. The EDOP flight sections from this case are being examined in detail. We are in the process of synthesizing the DC-8 and P3 flight level data, dropsondes, and other measurements, to document the vortex structure and persistence of the strong convective burst.

***Hurricane Humberto (9/22/01-9/24/01) (COVES case):*** Humberto was covered with 3 consecutive flight days and it has excellent airborne radar and dropsonde data sets. We are collaborating with other investigators on this storm. We have been focusing on the EDOP analyses, particularly on 9/22/01 where there is a mini-convective burst occurring during the aircraft flights. We also are examining the secondary circulation derived from EDOP 2D winds.

***Hurricane Erin (9/10/01):*** We are supporting the warm core study by J. Halverson and J. Simpson using ER-2 and DC-8 dropsondes. The EDOP observations provide a context for the dropsondes.

***KAMP convection (9/07/01, 9/19/01):*** These flights were over thunderstorms and stratiform rain. The flight goals were to obtain microphysics data under the ER-2 radar and radiometer measurements, with the two NASA aircraft and the NOAA P3 stacked; on some cases the P3 flew off to the side of the thunderstorms to collect Doppler wind fields under the NASA aircraft. These flights provide interesting additions to the data base provided by the TRMM field campaign observations. The 7 September flight had particularly strong convection but was away from the Key West network. We will focus on the EDOP aspects of this case and use the measurements for statistical studies we are performing on vertical reflectivity and Doppler profiles. The 19 September EDOP flight was well coordinated with other aircraft and ground-based radar. We will be using this case to augment our TRMM studies since there is radar and radiometer data from the ER-2 along with ground-based radar polarization and dual Doppler measurements. We also plan to collaborate with ground-based radar investigators (Biggerstaff, Anagnostu, etc.) since they have cloud modeling and combined (radar-radiometer) rain profile algorithm interests.

## **References**

Heymsfield, G. M., J. B. Halverson, J. Simpson, L. Tian, T.P. Bui, 2001: ER-2 Doppler radar investigations of the eyewall of Hurricane Bonnie during the Convection and Moisture Experiment-3. *J. Appl. Meteor.*, **40**, 1310-1330.

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